

AMATEUR SATELLITE REPORT

AMSAT's Newsletter for the Amateur Space Program.



Amateur Satellite Report is endorsed by the
American Radio Relay League as the special interest
Newsletter serving the Amateur Radio Satellite Community

Number 117
February 5, 1986

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FLASH

Reports from several stations February 2 suggest a new type of telemetry appearing on 29.400 MHz, a frequency used for RS telemetry. The launch of RS-9 and 10 had been anticipated later this month. G3IOR stated UA3CR was on vacation and unavailable for consultations. The observation reports seemed plausible giving observation times of about 20 minutes and intervals between sightings of 120 minutes. Together with reported Doppler shift, these reports are consistent with the altitude of the current generation of RS-birds. An all-points observation alert was initiated by WD0HHU, AMSAT Net Control Station at 1900 UTC, Sunday, 2 February, based on reports from JH2TNL and JR2DBE and relayed to AMSAT by JA9BOH and JR1SWB. Subsequent observation reports were made by ZS6AKV and W0RPK.

AO-10 Reaches Southern-most Extent This Month

Later this month AMSAT OSCAR 10 will reach its maximum southerly extent. With the slow precession of the orbital plane, apogee has been progressing more and more south since launch. Between February 28 and March 1st it will reach its maximum southerly travels when it reaches 26.33 degrees South, equal to its orbital inclination. Beginning March 1st, apogee will begin to move to the north reaching the equator in January 1987 and its most northerly latitude, 26.33 degrees north, in early 1988. The south to north trek takes about 22 months while a complete south to north to south cycle requires about 44 months.

Shuttle Challenger Loss Shocks, Saddens All

The cataclysmic loss of the Space Shuttle Challenger and its crew of 7 during a launch mishap Tuesday, January 28th, has sent shock waves through the Amateur Radio Community and much of the civilized world. Amateurs are especially bereaved because of their growing affinity for Ham-In-Space activities as most popularly embodied in the Amateur Radio activities of several astronaut-hams in the recent past.

Indeed, it is this real, direct contact with the Shuttle program and its participants which makes the loss felt by all mankind all the more poignant to thousands of Amateurs across the globe who have reached out and touched the Shuttle through the media of Amateur Radio. It is thus with

especial pain and sorrow that hams around the world reflect on our collective loss.

As recently as July 29, 1985, Challenger carried its crew including Astronaut-ham Tony England, W0ORE, to orbit. Very high levels of interest in the ham-in-space activities were evident then. Many looked forward to future missions not just for Amateur Radio aspects but perhaps out of a renewed interest in space that W0ORE and Owen Garriott, W5LFL, before him, helped rekindle.

What's clear even now from the tremendous outpouring of emotion at this tragedy is the enormous support the space program obtains. People seem ready to identify their hopes and dreams, their highest aspirations, with the team they see regularly climbing aboard a rocket and catapulting to orbit leaving earth and the frivolities of mankind, presumably behind. Now in the face of disaster there arises a collective sense of devastation and loss.

Meanwhile, as the nation attempts to put these tragic events behind it, the technicians begin the grim task of reconstructing the circumstances in order to ascertain the cause. Salvage crews are presently fishing larger and larger pieces of debris from the Atlantic. Reports from Navy and Coast Guard searchers seem to indicate major concentrations of debris have been found. Hopes for recovery of major portions of the craft have been buoyed. It remains an open question as to whether these horribly shattered components may yield any clues to the cause of the mishap.

At press time news reports based on recently released NASA photographs clearly show an anomalous plume of flame on the starboard SRB (solid rocket booster). These photographs lend credence to the "blowtorch" theory

whereby a 6,000 degree plume of flame bursting through an SRB seam near the base quickly burnt through the main tank igniting the cataclysmic explosion. NASA refused comment on this theory but sources close to the investigation were confident they would nail down the cause shortly. Others who refused to be quoted by name suggested the agency had already set June 1986 as the commencement of further launch activity.

What is most alarming in the newly released photographs is the realization that there was perhaps 12 to 16 seconds between the time when the anomalous SRB plume is visible and the explosion of the main tank. Questions have been raised concerning whether some indication of impending disaster was given by sensors and what could have been done. Aerospace experts familiar with the Shuttle program have stated that it was unlikely any sensors on the Shuttle detected the flame itself but that the anomalous plume should have shown some effects in the engine performance telemetry.

In fact, sources have said, gimbaling of the main engine nozzles, just the effect one would expect, and a slight (4%) reduction in thrust from the starboard SRB have been identified in the telemetry. Thus the danger signals were there in rudimentary form. However, experts interviewed by CBS News and the New York Times were unanimous in their view that even if the plume had been detected at its first appearance, it was highly unlikely anything could have been done in those vulnerable seconds to save the crew. The SRB burnout and separation normally occurs at about 2 minutes and 27 miles. The anomalous plume was visible beginning at about 1 minute. The explosion occurred at 1:12 and at about 10 miles.

The impact on America's space program in general is inevitably enormous. The loss of Challenger reduces the shuttle fleet by 25% to 3. (Atlantis, Discovery and Columbia). The payload aboard Challenger, the second Tracking and Data Relay Satellite, (TDRS) an 18.5 ton satellite, was essential to future space missions and vital government communications. Its loss is very damaging.

Delayed, if not outright cancelled, will be important commercial, military and scientific payloads. Thousands of man-years of effort are in jeopardy. Halley's Comet support activities from Shuttle are lost entirely. The singularly important Hubble Space Telescope now lies in a lurch. It was a payload planned for later this year. Now it's a question when this telescope, perhaps the most important astronomical instrument built since Galileo, will be launched.

Closer to the Amateur Radio community, future SAREX (Shuttle Amateur Radio Experiments) are of course tied to recovery of the Shuttle program. An indirect impact could manifest on the Phase 3C spacecraft to be launched by Ariane. Many important commercial payloads will probably seek replacement of Shuttle launches with the European Space Agency. This may require additional Ariane-1 launches before the first demonstration Ariane-4 launch currently scheduled for August. Phase 3C is due to be launched aboard the first Ariane 4 aside from any schedule flux introduced by the Shuttle disaster.

Meanwhile, expressions of sympathy have flowed into AMSAT and ARRL HQ from around the world both from IARU and affiliated AMSAT organizations. AMSAT member

Dick Daniels, W4PUJ, himself a NASA manager, accepted the well-wishes and encouragement on behalf of NASA and assured they would be passed on to NASA HQ.

AMSAT President Vern Riportella, WA2LQQ, sent the following on behalf of AMSAT and its members:

Memorium: The Heroes of Challenger

The tragic loss of Shuttle Challenger and her crew certainly marks the low point in man's brief experience in space. And we in AMSAT, members of a growing community of workers in space, share with the nation and all mankind a deep sense of loss.

Perhaps the grief we feel is amplified by the strong sense of identification and camaraderie we shared with these champions of the space age; these 21st century Charlemagnes.

But champions and heroes of all ages must deal with danger and risk. Although we who watch from the sidelines are barely aware of it, those who ride these missiles into orbit and those who prepare them know well, and always have, the price to be paid. Big rewards in knowledge and experience require big risks.

In fact, thoughtful persons in the aerospace industry knew this day would eventually come. It has come. And it has taken our friends and colleagues away in a flash. It has orphaned children, widowed husbands and wives and left us groping for answers.

What can we hope to learn from this tragic episode?

For one, we can come to more fully appreciate the nature of the space business and those who advance it. We can come to appreciate the character of the team of astronauts who point to the value of the mission while allowing us to ignore the risks they themselves undertake on our behalf in strapping a Roman candle onto their back. For another, we can appreciate what has already been provided by other heroes who've flown before and who have faced similar odds.

Will this tragedy affect America's space program? Of course it will. It will affect the way all mankind hereafter looks at space exploration.

But will it deter men from continuing the proud tradition? Not possible. Those who fly these wondrous machines, be they Americans, Canadians, Mexicans, Russians, Frenchman or whomever, will persist.

AMSAT, the Amateur Radio Community and space exploration in general will press on more aware than before of the debt we owe our colleagues and forever saddened when the toll for our expanded experience is exacted upon our friends.

Thus, in the final analysis, what will change profoundly in the wake of the loss of Challenger and her crew is the way those of us on the pad feel about those we watch ride into the heavens.

ASR Turns Six

With this issue ASR completes its fifth full year of publication. We thank you for your enthusiastic support of ASR, the Amateur Space Program, the collaborating organizations and the Editors. While we have endeavored to serve you well, we have never been completely satisfied with our work; there has always been too, too much to cram into a day to produce a newsletter that was/is "perfect". Nevertheless, the imperfections have been mostly tolerable over the years and the resultant 117 editions make an impressive stack indeed. Thank you on behalf of all those who've made these 5 years a success and have made ASR one of the most widely respected publications in the field.

AO-10 Operating Schedule

This following AO-10 operating schedule will be in effect until early March. The satellite is now in condition green but poor sun angles persist. Attitude maneuvering using magnetorquing will proceed during perigee passages until approximately February 7th. The objective of the maneuver is longitude 230 and latitude -5 degrees.

Here is the schedule:

Mode B	MA 040 to 199
Mode L	MA 200 to 216
Mode B	MA 217 to 225
Off	MA 226 to 039

The omni antenna has been in use from MA 230 to 099. However, the duration of use of the omni is expected to be reduced beginning about February 2. Check the beacon for details.

With Mode L moved to MA 200 to 216, the satellite is much closer to earth when Mode L is on. The reduced path loss has had a favorable effect. Mode L users report signals are quite strong now. This would seem an excellent opportunity, therefore, for QRP Mode L users to get on.

High power Mode B users may force reduction of operating times. All users are strongly advised to reduce power to equal Mode B beacon levels. If continued excessive power use goes unchecked, there will be no choice but to reduce operating time. Please pass the word.

As always, it's a good idea to monitor the beacon for advisories on schedule changes.

AMSAT Begins Publications Overhaul.

AMSAT recently began a re-organization of its publications interests in order to have its publications more completely respond to reader preferences. Included in the re-organization are all current publications as well as several others only in the planning stages.

AMSAT *Satellite Journal* in particular will be overhauled. Plans call for content, appearance, frequency of publication and staff changes. AMSAT officials are evaluating ways of developing a responsive publication of the size of the former ORBIT magazine in a less expensive format but to include quality material of interest to a broad spectrum of AMSAT members. Synthesis of this publication with that of other organizations with closely related interests is being considered as well.

Tied with changes in *Satellite Journal* will be changes in *Amateur Satellite Report*, ASR. Some have suggested ASR, or some derivation of it, become AMSAT's main publication in either a bi-weekly or monthly form. This approach is being considered as well.

On related matters, other AMSAT publications such as the AMSAT *Technical Journal* are planned to the overall plan to improve both the quality and reader satisfaction as well

the technical spectrum of AMSAT's publications. Other publications in the planning stages include a special 25th Anniversary OSCAR Celebration Yearbook.

According to President WA2LQQ, "The extent of these changes in publications may be substantial and, while every effort will be made to maintain continuity, some minor perturbations might logically be anticipated along the way while we get things sorted out."

Any changes in *Satellite Journal* will begin with issue #8. Issue #7 will be mailed shortly.

Satellite Nears Important Milestone

The next Amateur Radio satellite in the Phase 3 series is nearing completion as teams in Marburg, West Germany and the United States close in on important milestones leading to an anticipated August, 1986 launch.

Plans call for launch aboard an Ariane 4 this August. However, slips in the Ariane V16 launch in January to sometime in February may push the actual launch of Phase 3C into September.

At the Phase 3C integration facility in Golden, Colorado, AMSAT technicians are preparing the spacecraft for an all-important test. A full-up thermal-vacuum test is now scheduled for March 24. The thermal-vac facility has been made available to AMSAT by the Martin-Marietta plant in Denver. The test is crucial in determining if the spacecraft is flight-ready. The combination of heat and vacuum is designed to duplicate the environment of space in which Phase 3C will operate and to stress the components. This is standard practice to isolate any marginal components. These must be flushed out prior to launch to improve the life expectancy of the satellite.

Meanwhile, several of the important operating parameters for Phase 3C have been jointly announced by AMSAT DL and AMSAT. The following are the planned Phase 3C operating frequencies (there will be 4 transponders): Mode B, Mode JL, Mode L (RUDAK) and Mode S.

Mode B	
Uplink:	435.425 - 435.575 MHz
Downlink:	145.975 - 145.825 MHz
General Beacon:	145.8125 MHz
Engineering Beacon:	145.975 MHz
Mode JL	
L Uplink:	1269.575 - 1269.325 MHz
L Downlink:	435.725 - 435.975 MHz
General Beacon:	435.650 MHz
J Uplink:	145.64 - 146.04 MHz
J Downlink:	435.75 - 436.15 MHz Option 1
or	
J Uplink:	144.26 - 144.66 MHz
J Downlink:	435.75 - 436.15 MHz Option 2

It is currently undecided which of the two J input options shall be implemented. In either option, there is an overlap whereupon signals originated at 24 cm and 2 meters can result in a downlink between 435.725 and 435.750 MHz.

Digital Mode L (RUDAK)	
Uplink:	1269.675 MHz
Downlink:	435.675 MHz

RUDAK is a digital-only transponder which will use PSK.

Mode S	
Uplink:	435.625 MHz
Downlink:	2401.337 MHz
S Beacon:	2401.267 MHz

Mode S will be a soft-limited FM transponder which can also accommodate up to 4 SSB signals.

Although minor revisions in frequency may be anticipated, the frequencies presented are those currently planned.

Orbit Predictions

By WA2LQQ & KA9Q

Reference Orbits

Note: Positive longitudes are East;
negative longitudes are West.

Keplerian Elements

Satellite OSCAR-9
Catalog number: 12888
Epoch time: 86021.44693719
Tue Jan 21 10:43:35.373 1986 UTC
Element set: 841
Inclination: 97.6467 deg
RA of node: 19.4507 deg
Eccentricity: 0.0001774
Arg of perigee: 182.4950 deg
Mean anomaly: 177.6313 deg
Mean motion: 15.27963448 rev/day
Decay rate: 1.182e-05 rev/day²
Epoch rev: 23855
Semi major axis: 6857.003 km
Anom period: 94.243092 min
Apogee: 480.114 km
Perigee: 477.681 km
Ref perigee: 2942.41464451
Tue Jan 21 09:57:05.285 1986 UTC
Beacon: 145.8250 MHz

Satellite OSCAR-10
Catalog number: 14129
Epoch time: 86021.11151535
Tue Jan 21 02:40:34.926 1986 UTC
Element set: 222
Inclination: 26.2618 deg
RA of node: 98.9322 deg
Eccentricity: 0.5984507
Arg of perigee: 79.3957 deg
Mean anomaly: 339.0085 deg
Mean motion: 2.05860519 rev/day
Decay rate: -1.07e-06 rev/day²
Epoch rev: 1963
Semi major axis: 26105.096 km
Anom period: 699.502754 min
Apogee: 35353.609 km
Perigee: 4108.383 km
Ref perigee: 2942.13984022
Tue Jan 21 03:21:22.194 1986 UTC
Translate freq: 581.0047 MHz
Invert: 1
Beacon: 145.8100 MHz

Satellite OSCAR-11
Catalog number: 14781
Epoch time: 86017.20691819
Fri Jan 17 04:57:57.731 1986 UTC
Element set: 112
Inclination: 98.1689 deg
RA of node: 86.1471 deg
Eccentricity: 0.0012245
Arg of perigee: 279.9045 deg
Mean anomaly: 80.0770 deg
Mean motion: 14.62019169 rev/day
Decay rate: 7.3e-07 rev/day²
Epoch rev: 10030
Semi major axis: 7061.875 km
Anom period: 98.493921 min
Apogee: 712.711 km
Perigee: 695.416 km
Ref perigee: 2938.19170388
Fri Jan 17 04:36:03.215 1986 UTC
Beacon: 145.8260 MHz

Satellite RS-5
Catalog number: 12999
Epoch time: 86019.86587799
Sun Jan 19 20:46:51.858 1986 UTC
Element set: 289
Inclination: 82.9570 deg
RA of node: 187.2066 deg
Eccentricity: 0.0009050
Arg of perigee: 349.1576 deg
Mean anomaly: 10.9279 deg
Mean motion: 12.05061960 rev/day
Decay rate: 4e-08 rev/day²
Epoch rev: 18000
Semi major axis: 8033.802 km
Anom period: 119.495930 min
Apogee: 1663.673 km
Perigee: 1649.132 km
Ref perigee: 2940.86335901
Sun Jan 19 20:43:14.218 1986 UTC

Satellite RS-7
Catalog number: 13001
Epoch time: 86012.47983642
Sun Jan 12 11:30:57.866 1986 UTC
Element set: 234
Inclination: 82.9586 deg
RA of node: 185.4521 deg
Eccentricity: 0.0021621
Arg of perigee: 285.7083 deg
Mean anomaly: 74.1597 deg
Mean motion: 12.08695400 rev/day
Decay rate: 4e-08 rev/day²
Epoch rev: 17965
Semi major axis: 8017.683 km
Anom period: 119.136716 min
Apogee: 1676.393 km
Perigee: 1641.723 km
Ref perigee: 2933.46279332
Sun Jan 12 11:06:25.342 1986 UTC

Satellite NOAA-9
Catalog number: 15427
Epoch time: 86016.32397729
Thu Jan 16 07:46:31.637 1986 UTC
Element set: 62
Inclination: 98.9783 deg
RA of node: 334.7563 deg
Eccentricity: 0.0014773
Arg of perigee: 219.4310 deg
Mean anomaly: 140.5786 deg
Mean motion: 14.11402249 rev/day
Decay rate: 2.8e-07 rev/day²
Epoch rev: 5641
Semi major axis: 7229.897 km
Anom period: 102.026194 min
Apogee: 870.850 km
Perigee: 849.488 km
Ref perigee: 2937.29631005
Thu Jan 16 07:06:41.187 1986 UTC
Beacon: 137.5000 MHz

Sunday, February 2, 1986

OSCAR-9

Sun Feb 2 00:55:08.602 1986 UTC:
Ascending node at -114.4
Nodal period: 94.30170 min
Longitude increment:
23.572716 deg w/orbit
Element set 841, epoch:
Tue Jan 21 10:43:35.373 1986 UTC

OSCAR-11

Sun Feb 2 00:23:35.277 1986 UTC:
Ascending node at -36.0
Nodal period: 98.55247 min
Longitude increment:
24.637856 deg w/orbit
Element set 112, epoch:
Fri Jan 17 04:57:57.731 1986 UTC

RS-5

Sun Feb 2 01:35:41.412 1986 UTC:
Ascending node at 24.1
Nodal period: 119.55237 min
Longitude increment: 30.015081 deg
w/orbit
Element set 289, epoch: Sun Jan 19
20:46:51.858 1986 UTC

RS-7

Sun Feb 2 00:10:54.453 1986 UTC:
Ascending node at 39.6
Nodal period: 119.19340 min
Longitude increment:
29.925265 deg w/orbit
Element set 234, epoch:
Sun Jan 12 11:30:57.866 1986 UTC

NOAA-9

Sun Feb 2 01:18:05.550 1986 UTC:
Ascending node at -160.0
Nodal period: 102.08288 min
Longitude increment:
25.519632 deg w/orbit
Element set 62, epoch:
Thu Jan 16 07:46:31.637 1986 UTC

Wednesday, February 5, 1986

OSCAR-9

Wed Feb 5 01:13:00.735 1986 UTC:
Ascending node at -118.7
Nodal period: 94.30126 min
Longitude increment:
23.572605 deg w/orbit
Element set 841, epoch:
Tue Jan 21 10:43:35.373 1986 UTC

OSCAR-11

Wed Feb 5 00:39:53.782 1986 UTC:
Ascending node at -40.1
Nodal period: 98.55246 min
Longitude increment:
24.637853 deg w/orbit
Element set 112, epoch:
Fri Jan 17 04:57:57.731 1986 UTC

RS-5

Wed Feb 5 01:19:34.535 1986 UTC:
Ascending node at 23.6
Nodal period: 119.55237 min
Longitude increment:
30.015083 deg w/orbit
Element set 289, epoch:
Sun Jan 19 20:46:51.858 1986 UTC

RS-7

Wed Feb 5 01:41:03.821 1986 UTC:
Ascending node at 12.3
Nodal period: 119.19342 min
Longitude increment:
29.925270 deg w/orbit
Element set 234, epoch:
Sun Jan 12 11:30:57.866 1986 UTC

AO-10 Apogees

The first apogee of each UTC day with SSP.

Day	Date	Time	Latitude	Longitude
Sun	02Feb	00:59:04	26.1s	147.8w
Mon	03Feb	00:18:04	26.1s	138.4w
Tue	04Feb	11:16:33	26.1s	304.2w
Wed	05Feb	10:35:32	26.2s	294.8w
Thu	06Feb	09:54:33	26.2s	285.4w
Fri	07Feb	09:13:33	26.2s	276.0w
Sat	08Feb	08:32:32	26.2s	266.5w

NOTE: AO-10's apogee will reach its southernmost extent between 28 Feb and 01 Mar. Apogee will then occur at 26.33 degrees South. Thereafter, apogee will move north until reaching 26.33 degrees North in January, 1988, approximately 22 months hence.

Amateur Satellite Report is published and mailed First Class bi-weekly for the Radio Amateur Satellite Corporation. The purpose is to enhance communications about the Amateur Radio Satellite Program. Subscription rates for the United States, Canada, and Mexico are \$22.00; Foreign is \$30.00. The rate covers 26 issues (typically one year). Send check or money order in U.S. funds (drawn on U.S. banks only please) to "Satellite Report," 221 Long Swamp Road, Wolcott, CT 06716. Information contained herein may be quoted without permission provided credit is given to Amateur Satellite Report, Wolcott, CT 06716. Amateur Satellite Report is Copyright Protected and duplication of this publication in any way including by the photocopy process or by electronic means (computer data banks, etc.) is not permitted under any circumstances. Amateur Satellite Report is endorsed by the ARRL as the special interest newsletter serving the Amateur Radio Satellite Community. The editorial opinions expressed are not necessarily those of the ARRL.